

# **Level 3 Revisited: Monthly Means, Climatologies, and AIRS L3 Lite**

Thomas Hearty, Andrey Savtchenko, Mike Theobald, Feng Ding, Ed Esfandiari,  
Ed Seiler, Fan Fang, Bruce Vollmer, Chris Lynnes

Goddard Earth Science Data Information and Services Center (GES DISC)

# Outline

- Update to Giovanni: G4 vs. G3
- Climatology product
- Level 3 Sampling
- Level 3 Lite: smaller files, faster downloads

# Update to Giovanni

- Giovanni-3
  - Provides AIRS Version 5 data
  - Unofficial AIRS climatology is used to calculate anomalies
- Giovanni-4 (aka “G-4,” “agile Giovanni,” “AG”)
  - Provides AIRS Version 6 data
  - faster
  - new features
  - Currently No Climatology, thus no anomalies

# Giovanni-3

## AIRS Online Visualization and Analysis AIRS Global 1.0° x 1.0° (2.5° x 2.0° for CO2) Monthly Level-3 Products

[Home](#)

[Remove All](#)

To build on the success of the previous version of the Giovanni online analysis tool, this Giovanni-3 interface has been redesigned to improve visualization and analysis of the AIRS Global 1.0° x 1.0° (except CO2 which is in 2.5° x 2.0° lonlat bin) monthly Level-3 Products. By choosing various data services below, users can create area plots, time series plots, Hovmöller diagrams and animations or compare different flavors of AIRS Level-3 data. Results can be downloaded either in HDF or ASCII format. Please check [data availability](#) to ensure a successful run.

Select:

**Parameters**


**Display:** ☒ Data Product Info ☐ Climatology Info ☐ Units ☐ Parameters with > 2 Dimensions ☐ Only Parameters with Climatology

**Analysis Options:** ☒ Parameter ☐ Climatology ☐ Anomaly [Show Notes...](#)

☐ AIRX3C2M.005(2002/09 - 2012/02)  
**Parameter:**  
☒ CO<sub>2</sub> fraction  
**Data Product Info:**  
Aqua - AIRS Level 3 V5 standard

☐ AIRX3STM.005(2002/09 - 2013/02)  
**Parameter:**  
☐ CH4 degree of freedom\_descending (CH4\_dof\_D)  
☐ CH4 degree of freedom\_ascending (CH4\_dof\_A)  
☐ CH4 volume mixing ratio\_ascending (CH4\_VMR\_eff\_A) (3 Levels) (3D)  
☐ CH4 volume mixing ratio\_descending (CH4\_VMR\_eff\_D) (3 Levels) (3D)  
☐ CO degree of freedom\_ascending (CO\_dof\_A)  
☐ CO degree of freedom\_descending (CO\_dof\_D)  
**Data Product Info:**  
Aqua - AIRS Level 3 V5 standard  
Aqua - AIRS Level 3 V5 standard  
Aqua - AIRS Level 3 V5 standard  
Aqua - AIRS Level 3 V5 standard  
Aqua - AIRS Level 3 V5 standard  
Aqua - AIRS Level 3 V5 standard  
Aqua - AIRS Level 3 V5 standard

**Spatial**

**Cursor Coordinates:**  
  
**Area of Interest:** West: -180 North: 90 South: -90 East: 180 [Update Map](#)

- Provides AIRS Version 5 data
- Unofficial AIRS climatology is used to calculate anomalies



# Giovanni-4

**Giovanni** The Bridge Between Data and Science v 4.10 [Release Notes](#) [Browser Compatibility](#) [Known Issues](#)

**Select Plot**  
Choose a plot type:

☒ Maps: Time-Averaged ☐ Comparisons: Select... ☐ Time Series: Select... ☐ Vertical: Select... ☐ Miscellaneous: Select...

**Select Date Range (UTC)**  
Format: YYYY-MM-DD

- - 00 hrs to - - 23 hrs

Valid Range: 1979-01-01 to 2014-09-26

**Select Region (Bounding Box)**  
Format: West, South, East, North

-180, -90, 180, 90

**Select Variables**

► Disciplines  
► Measurements  
▼ Platform / Instrument

- ☐ AIRS (80)
- ☐ GOCART Model (9)
- ☐ MISR (1)
- ☐ MODIS-Aqua (8)
- ☐ MODIS-Terra (9)
- ☐ NLDAS Model (3)
- ☐ OMI (5)
- ☐ SSMI (4)
- ☐ SeaWiFS (12)
- ☐ TRMM (2)

► Wavelengths  
► Depths  
► Spatial Resolutions  
► Temporal Resolutions  
► Portal

Number of matching Variables: 0 of 133

Total Variable(s) included in Plot: 0

Keyword:

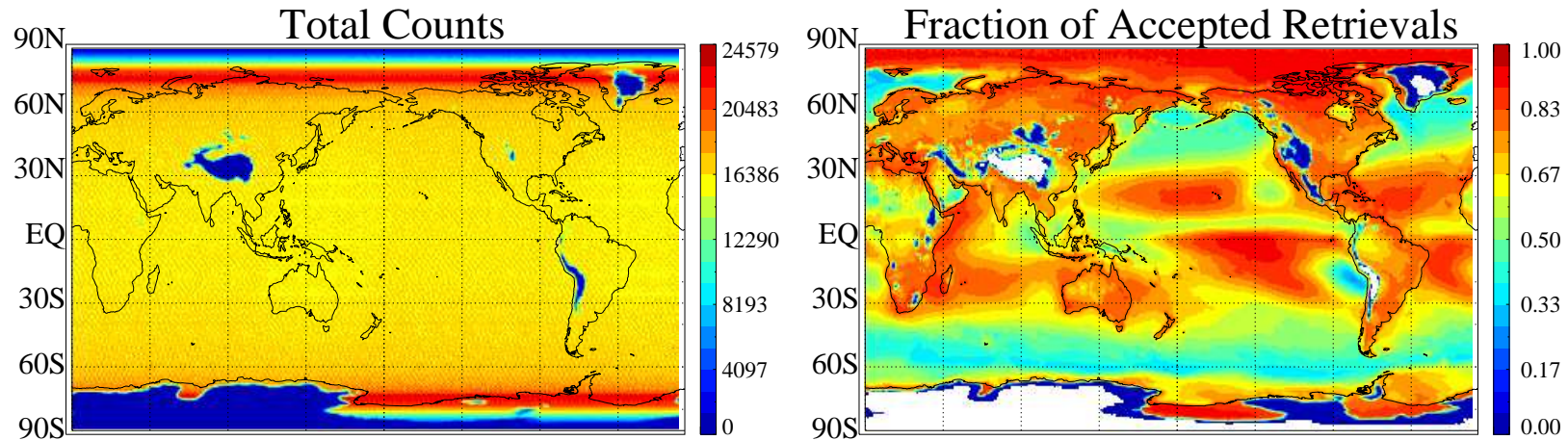
- Provides AIRS Version 6 data
- faster
- new features
- Currently No Climatology, thus no anomalies

# AIRS Climatology

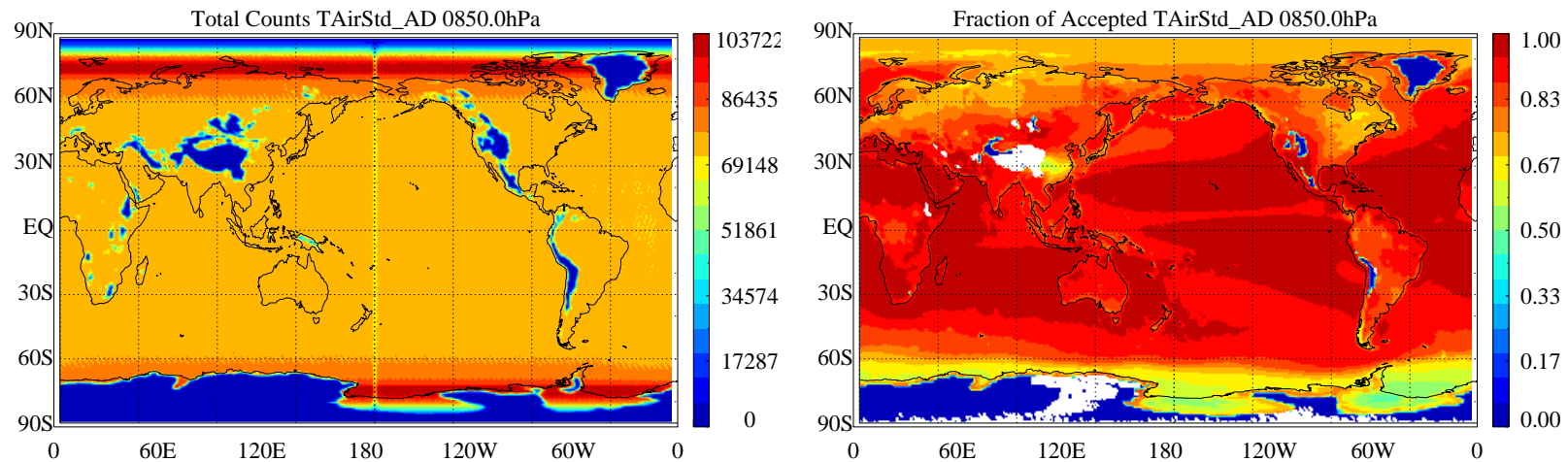
- Giovanni-3 used a climatology created offline from AIRS Version 5 Monthly Mean data.
- At the last science team meeting we proposed using the Level 3 PGE to create a monthly climatology product that would average over all Januaries, Februaries, etc.
- Problem: The Level 3 code calculates a weighted mean for each grid cell based on the number of counts. An arithmetic mean may reduce the sampling bias for multiday products.
- Giovanni-4 will probably get another unofficial climatology created from AIRS Version 6 data.
- Version 6 has improved sampling but we can still make improvements in the Level 3.

# Increased Yield in version 6

## Version 5

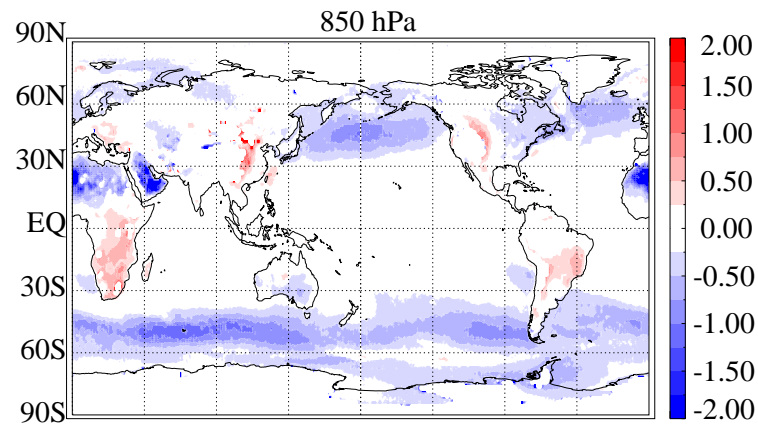


## Version 6

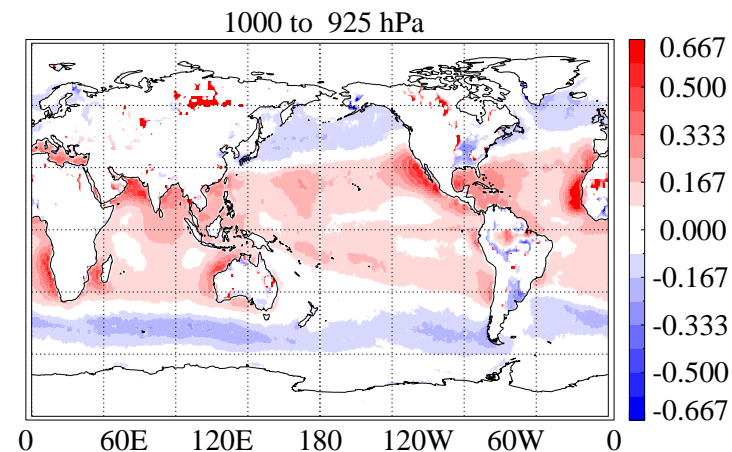
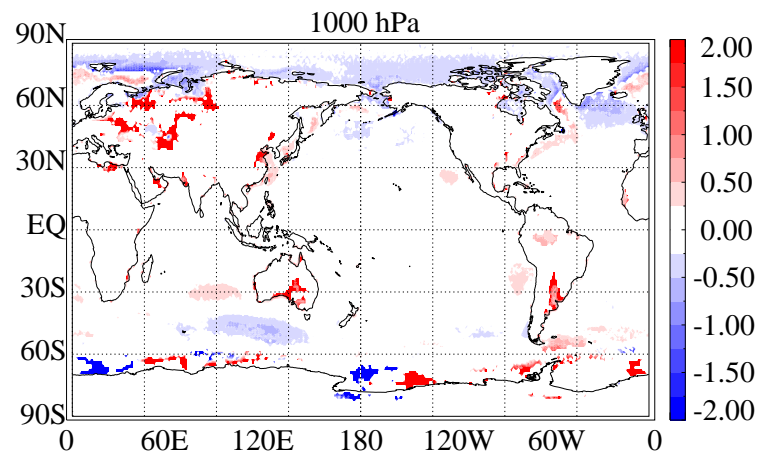
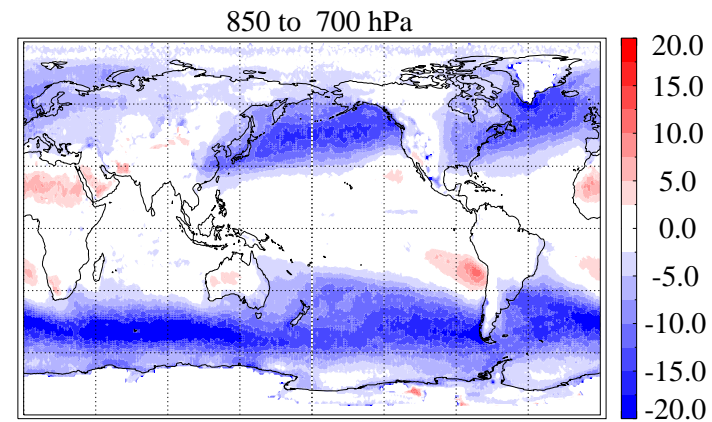


# Sampling Bias Estimate

## Temperature



## Water Vapor

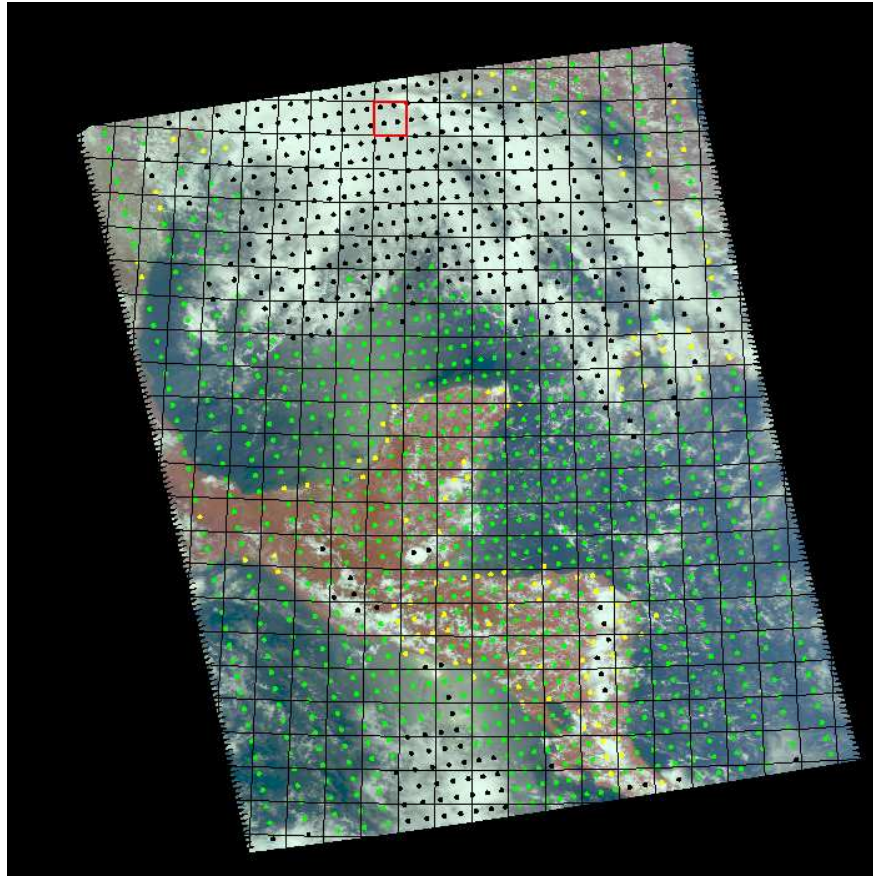


Using Version 5 quality control applied to MERRA data we found a warm bias in the boundary layer (Hearty et al. 2014). Other regions may have cold, dry, or wet biases. Version 6 sampling bias will be significantly less.

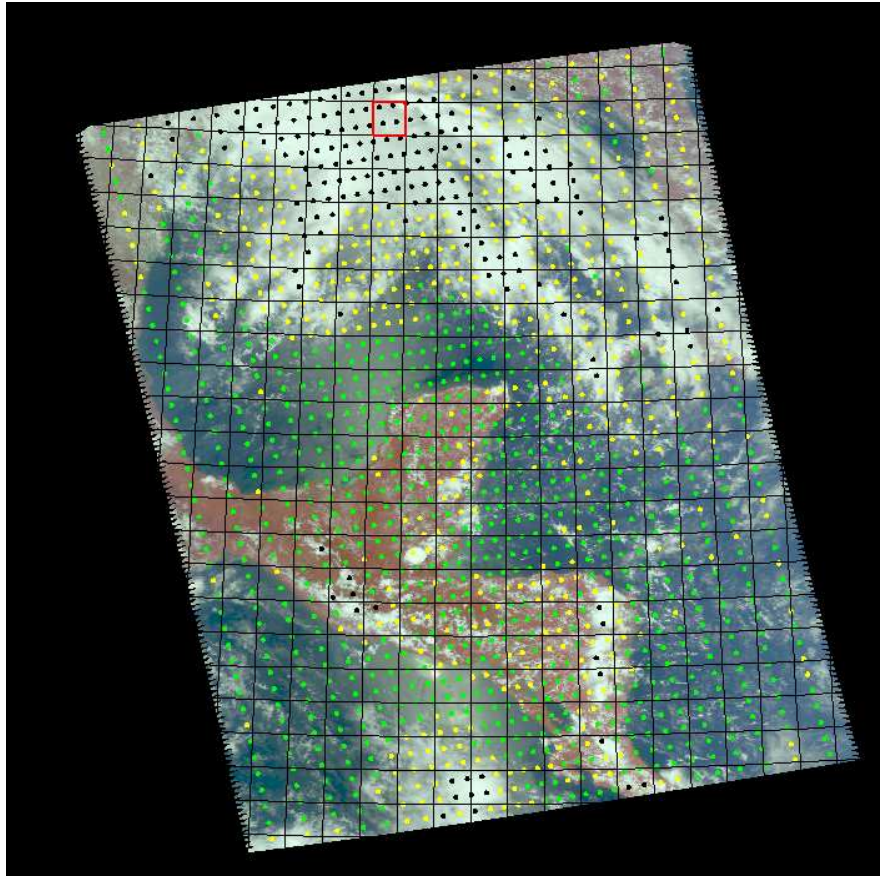


# Increased Yield of Level 2 data

Version 5



Version 6



The Version 6 algorithms has more successful retrievals in cloudy regions. The dots show the quality for the Temperature retrieval at 850 hPa.

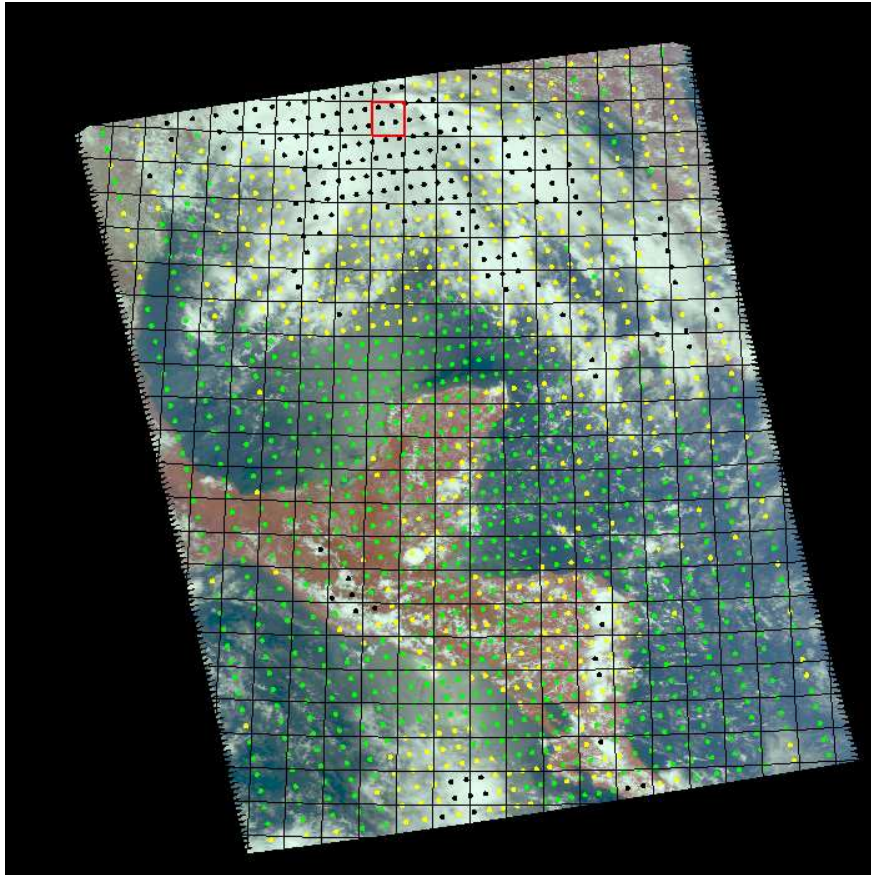
Green Quality = 0

Yellow Quality = 1

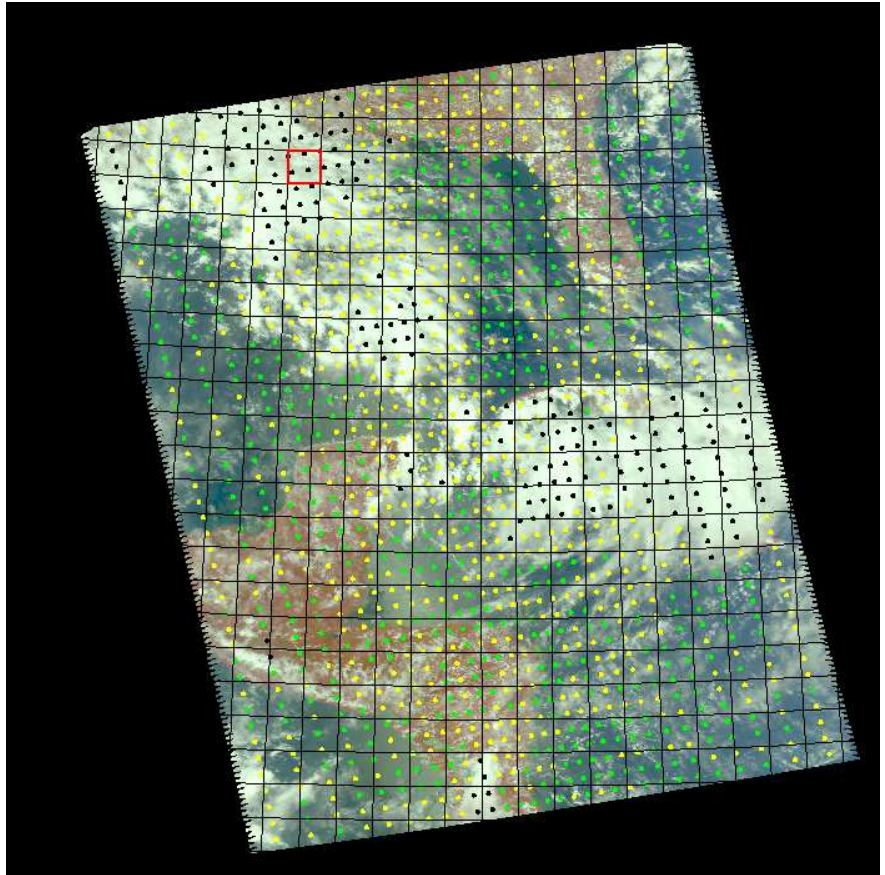
Black Quality = 2

# Version 6 Data

September 6, 2002



September 8, 2002

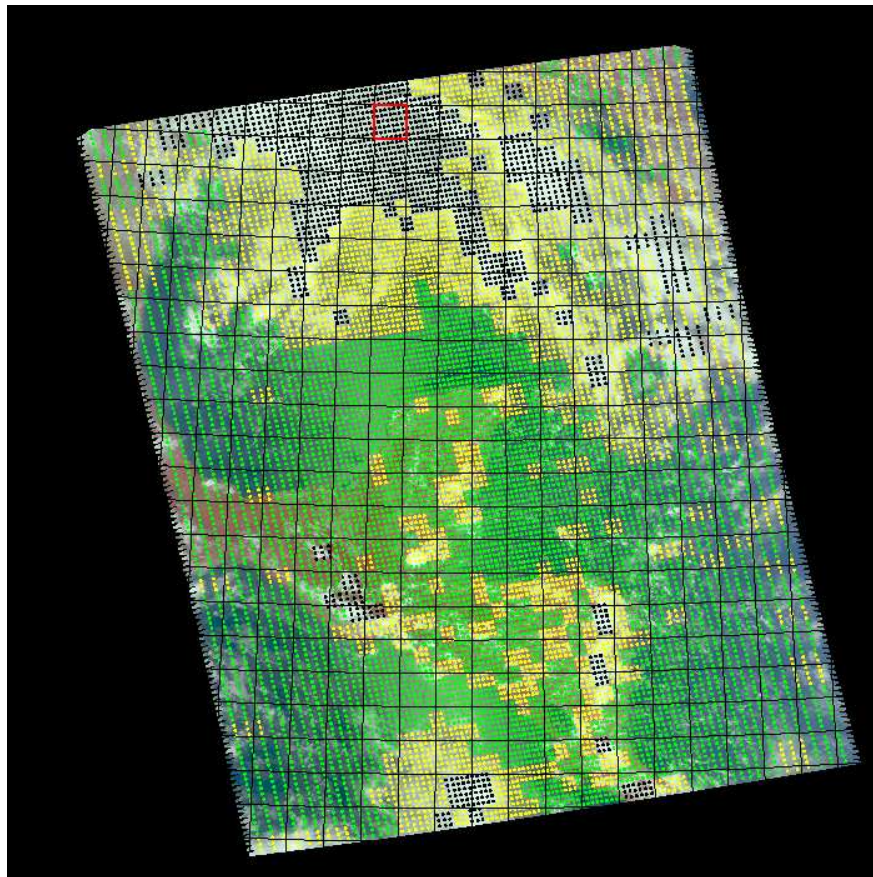


Still there are no successful retrievals over New Orleans (red square) on September 6, 2002 (or even 2 days later).

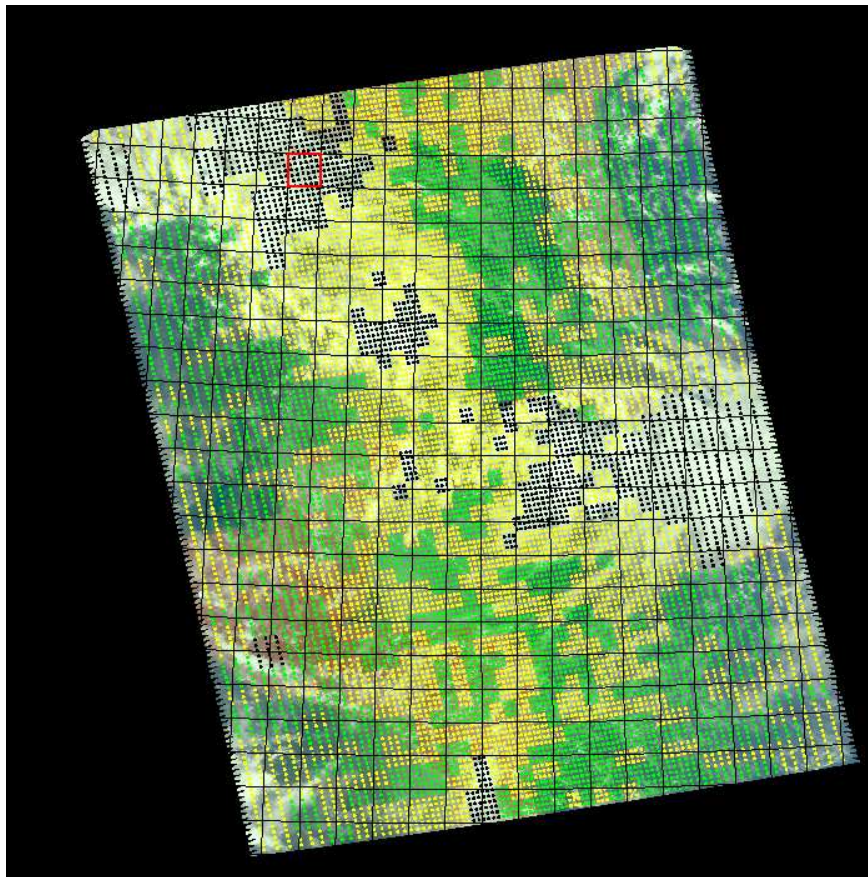


# Version 6 Data

September 6, 2002

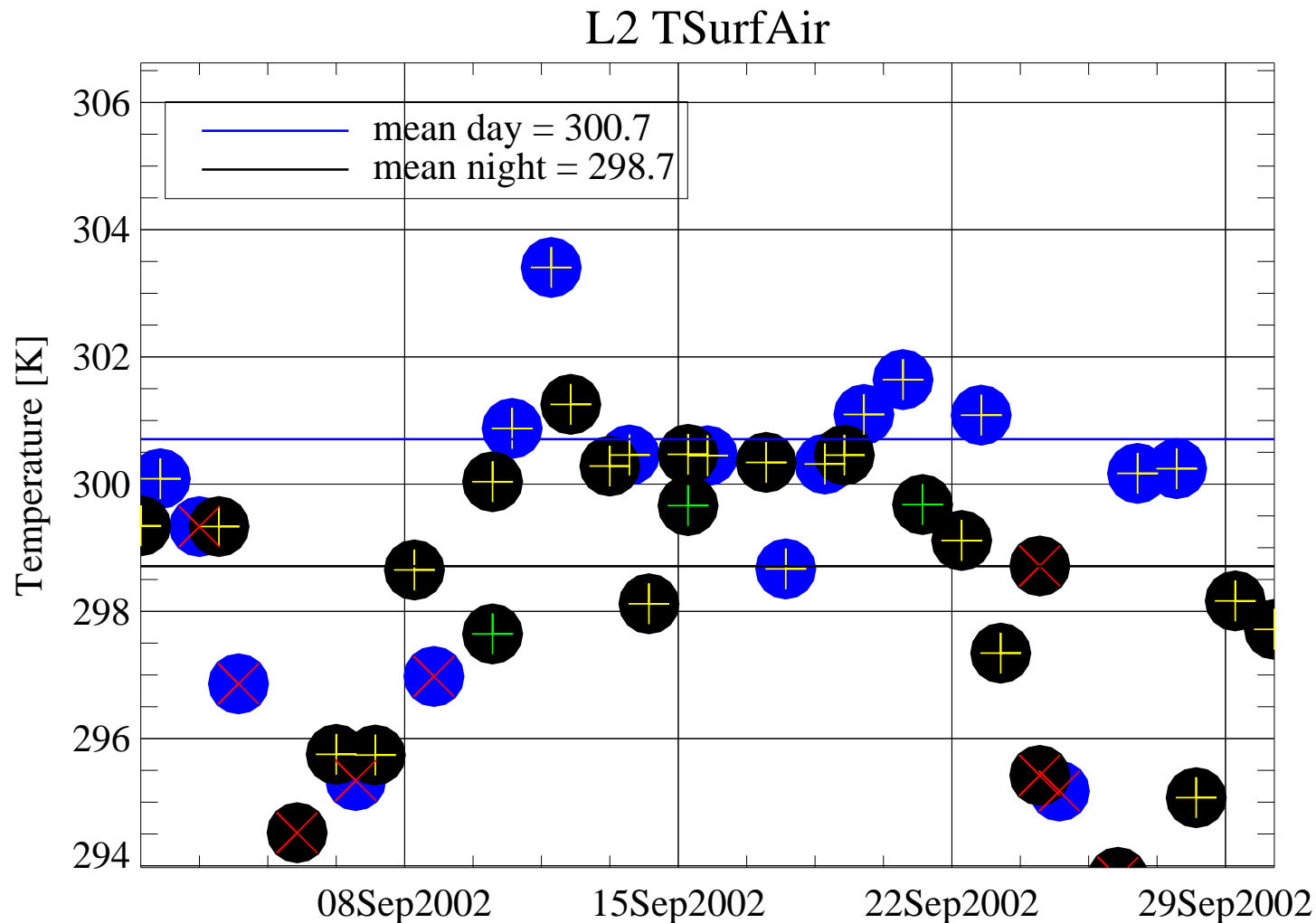


September 8, 2002



Even with the new gridding method that includes AIRS footprints overlapping with the grid cell there are no retrievals on these days.

# L2 TSurfAir over New Orleans



It is warmer in the day than at night. The daytime retrievals on September 6th and 8th are flagged as “Do not use.” N.B. all of the rejected retrievals are  $\leq$  the average of the valid data.



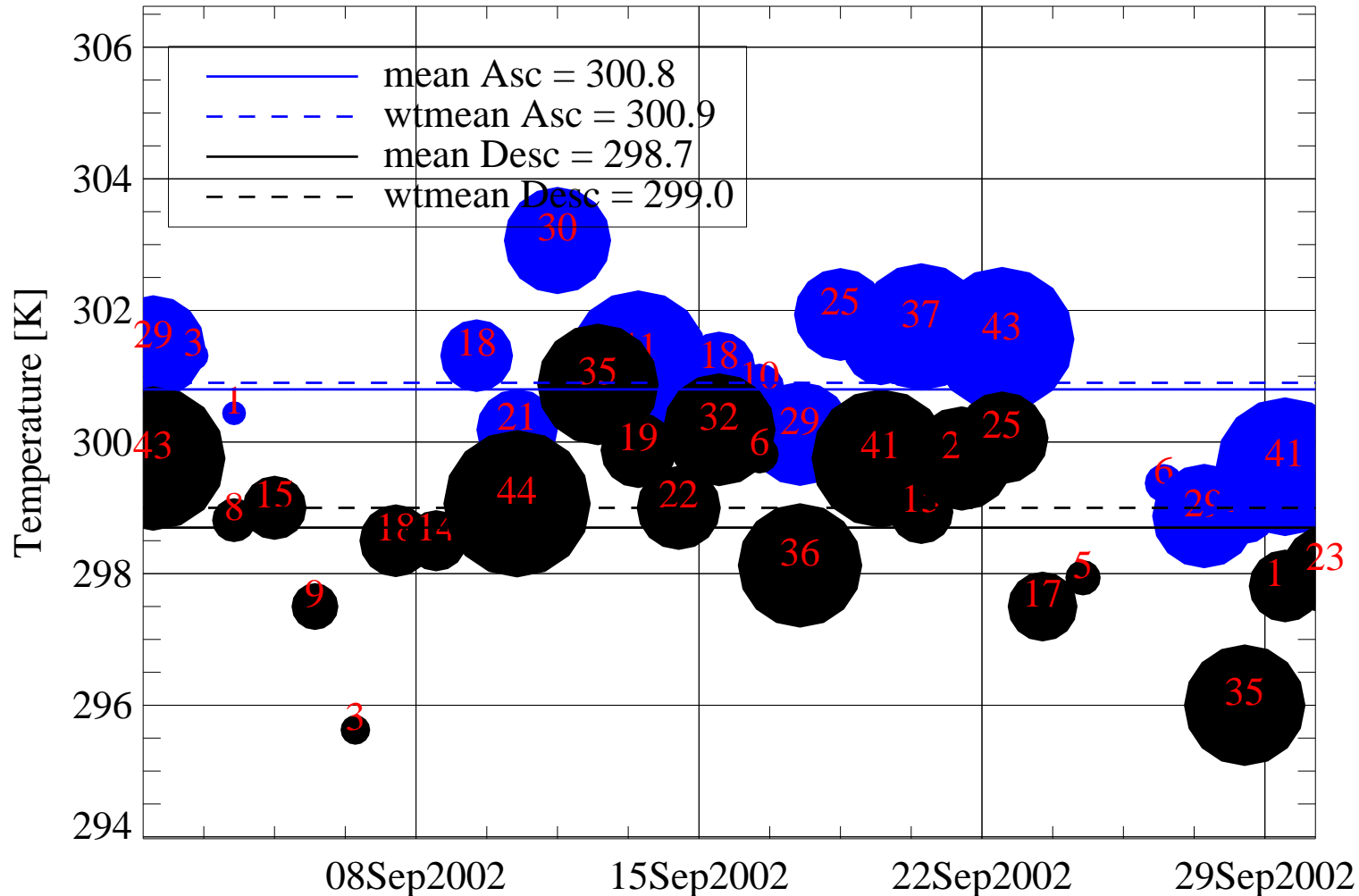
# Landsat image of New Orleans



The bridge across lake Pontchartrain is  $\sim 38.28$  kilometers (23.79 mi).

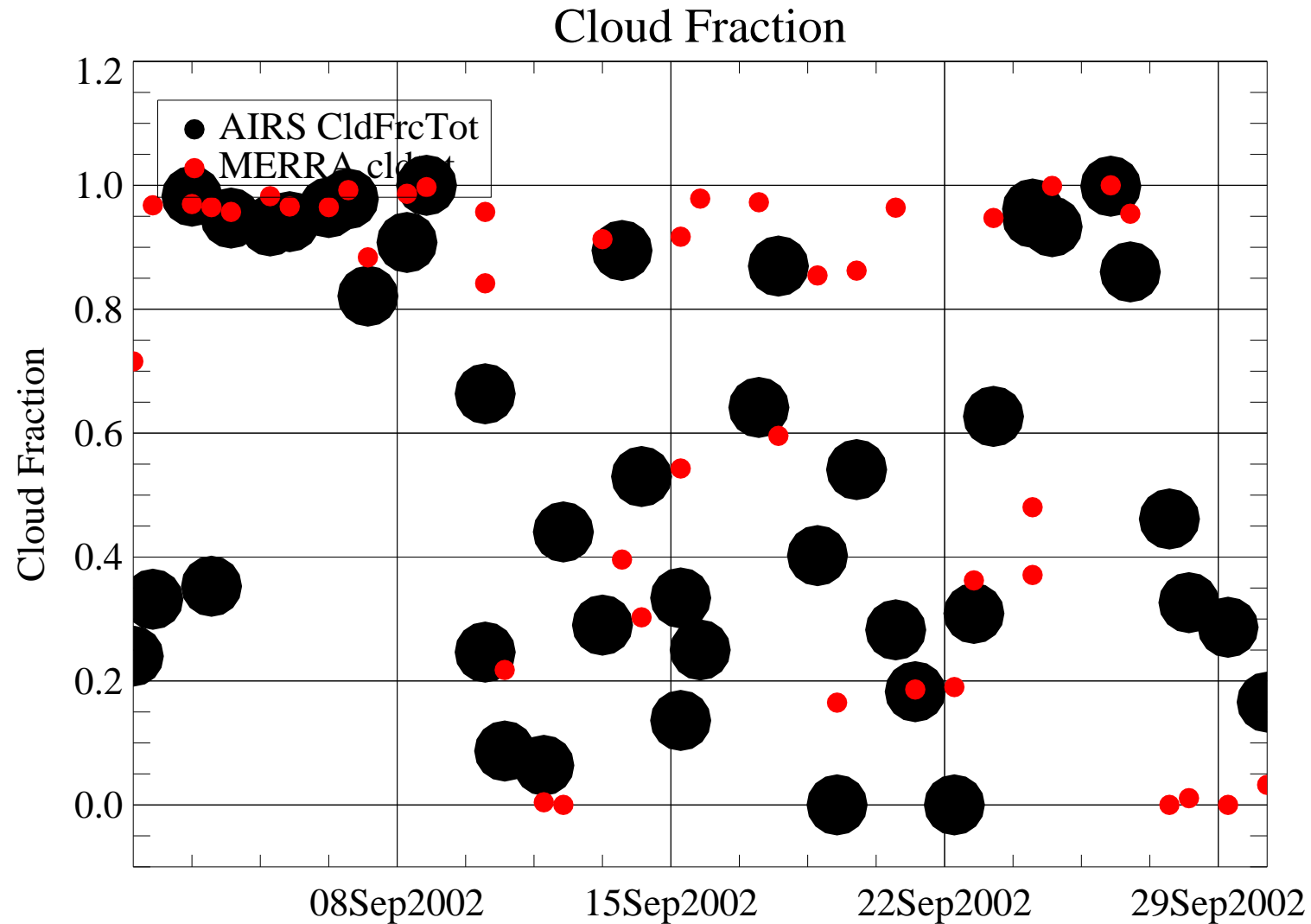
# Level 3 Time Series

L3 SurfAirTemp



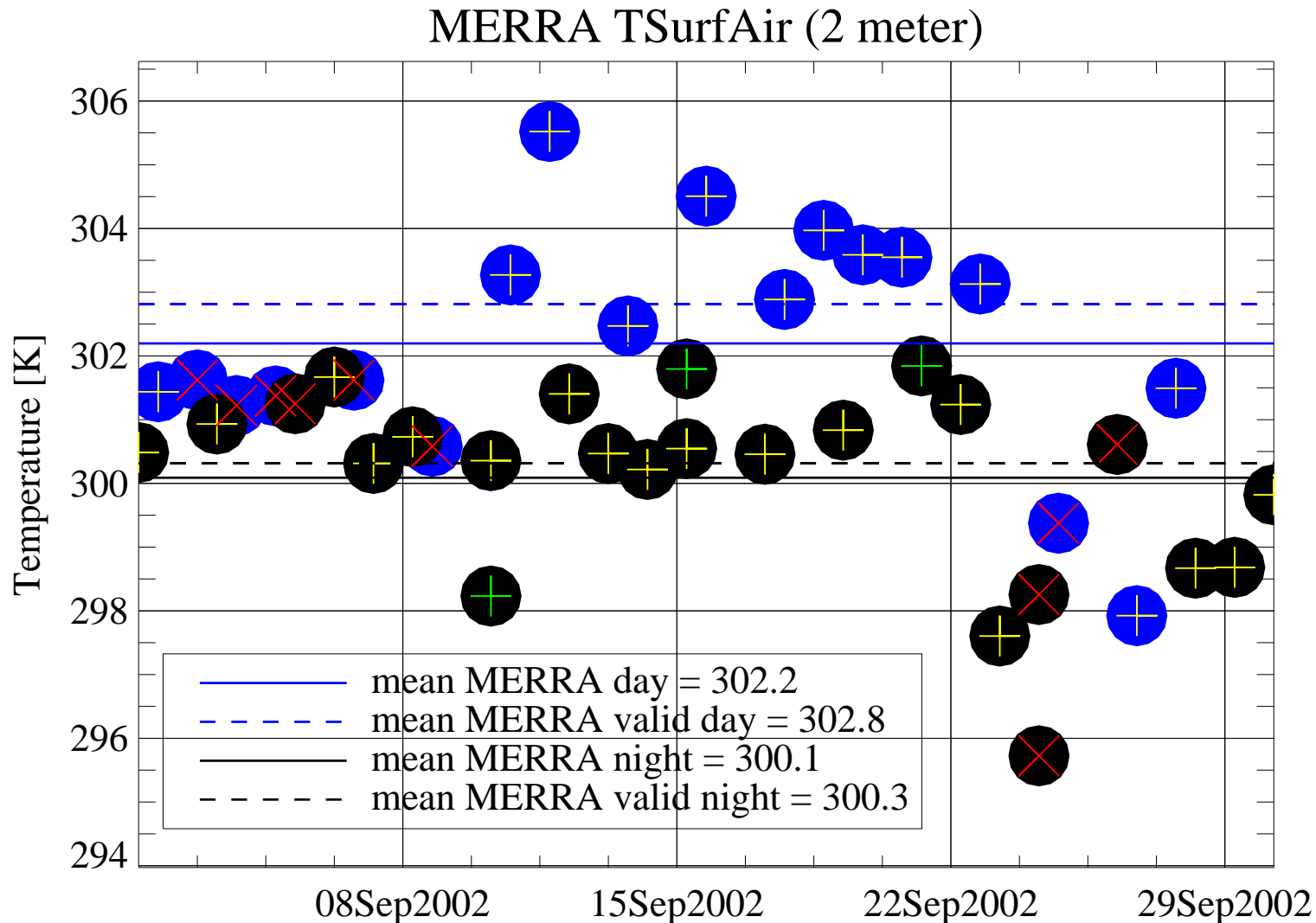
The difference between the weighted and unweighted means is  $\sim 0.1$  K for this case. Are the cold retrievals bad?

# AIRS and MERRA



AIRS and MERRA both agree those days were cloudy.

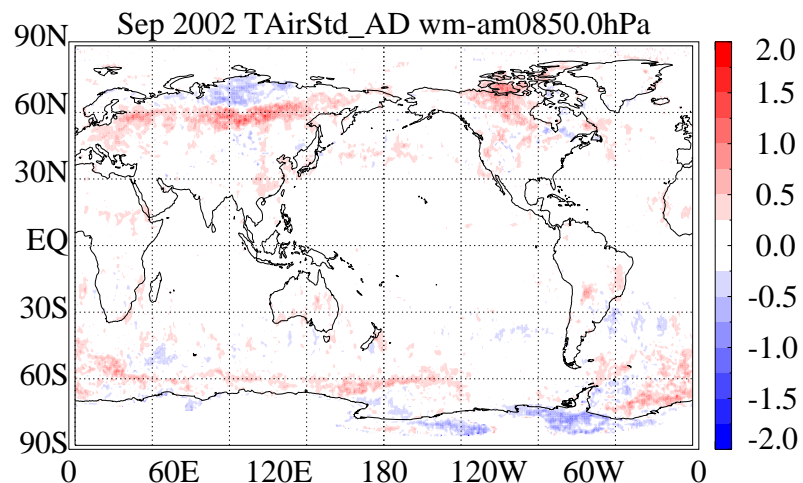
# MERRA Sampled Like AIRS



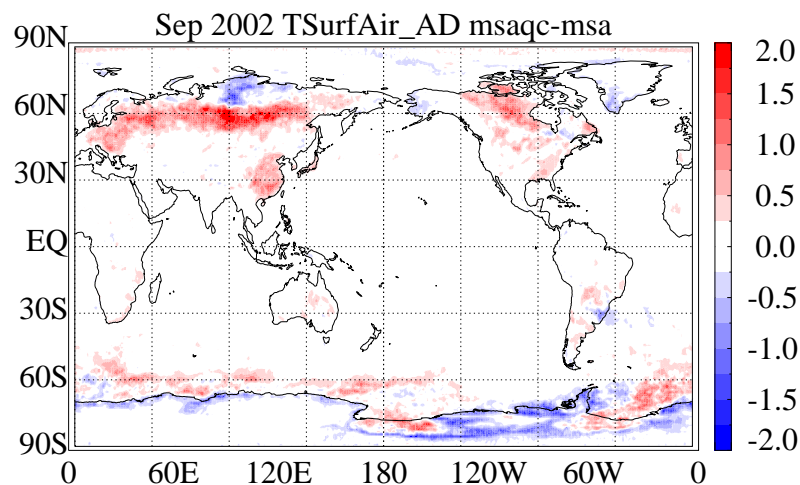
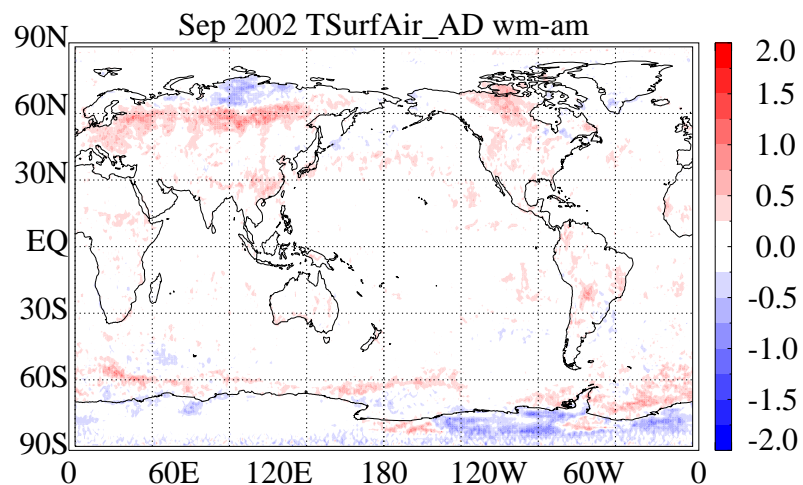
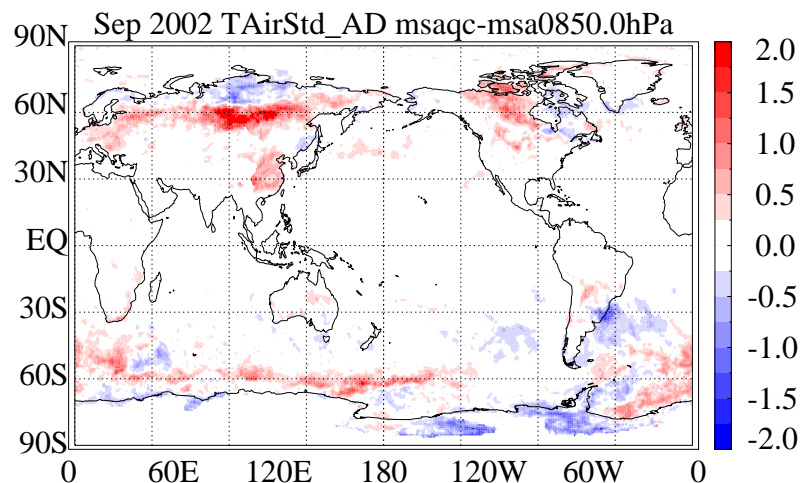
The valid data tends to be warmer according to MERRA. Giving those observations more weight might increase the sampling bias.

# Weighting and Rejecting

## Arithmetic Mean - Wt Mean



## MSAQC-MSA



# L3 Lite

File Type	Number of Variables	Size (Megabytes)
Version 5 AIRX3STD 2002.09.06 (hdf-eos)	268	76
Version 6 AIRX3STD 2002.09.06 (hdf-eos)	785	400
“Level 3 Lite” Just mean and counts for the A and D grids (netcdf3 or ascii)	$\leq 132$	$\leq 165$ (53 compressed)

# L3 Lite

<http://disc.gsfc.nasa.gov/SSW>

[EOSDIS Home](#)

## SIMPLE SUBSET WIZARD (SSW) [V1.07 RELEASE NOTES](#)

1. Search for Data Sets    2. Select Subset Criteria    3. View Results

*Enter values for the Date Range and (optionally) the Spatial Bounding Box to search for data sets; those criteria will also be used when data sets are subsetted by Date Range and Spatial Region.*

Data Set Keyword(s)

*Enter keywords or click the 'Select Data Sets' button.*

AIRS Lite

Select Data Sets

Date Range

*Enter dates as YYYY-MM-DD or use the calendars.*

2002-09-06



to

2002-09-06



Spatial Bounding Box

*Enter South,West,North,East coordinates or use the map.*



Search for Data Sets

[Report a Problem with the Simple Subset Wizard](#)



# L3 Lite

<http://disc.gsfc.nasa.gov/SSW>

EOSDIS Home

## SIMPLE SUBSET WIZARD (SSW) [V1.07 RELEASE NOTES](#)

1. Search for Data Sets 2. **Select Subset Criteria** 3. View Results

Found 4 subsettable data sets.

**Subset: Variables for AIRX3STD v006Lite** in

*Number of Variables selected=20*

- ☐ Ancillary Variables
- ☐ Cloud Layer Variables (3-D)
- ☐ Cloud Total Column and Cloud Top Variables (2-D)
- ☐ Geopotential Height Variables
- ☒ Moisture Profile Variables (3-D)
- ☐ Moisture Total Column and Surface Variables (2-D)
- ☐ Radiation Variables
- ☐ Surface Pressure Variables
- ☒ Temperature Profile Variables (3-D)
  - ☒ ascending:Temperature\_A
  - ☒ ascending:Temperature\_A\_ct
  - ☒ descending:Temperature\_D
  - ☒ descending:Temperature\_D\_ct
- ☐ Temperature Surface Variables (2-D)
- ☐ Trace Gas Profile Variables (3-D)
- ☐ Trace Gas Total Column Variables (2-D)
- ☐ Tropopause Variables (2-D)

**Subset: Variables for AIRX3STM v006Lite** in

**Subset: Variables for AIRX3STD v006LiteTqJ** in

**Subset: Variables for AIRX3STM v006LiteTqJ** in



# Conclusions

- Use the “Feedback” button on Giovanni-4 or ask me to request additional variables or plot types.
- PGE is capable of running in “climatology mode” but some sampling issues should be considered first.
- The bias due to weighting is just a small part of the sampling bias.
- G4 will likely get another unofficial climatology.
- In the mean time users may want to download the “L3 Lite” product to make their own monthly climatologies.